

HF AUTO-TUNER OVERVIEW



THOUSANDS
OF PRE-
PROGRAMMED
SOLUTIONS

512 DEDICATED
MEMORY
CHANNELS
FOR USERS

USING SWA'S
PROPRIETARY
TUNE ONCE
TECHNOLOGY

COMPACT
SIZE OF
A 16 Oz.
BEVERAGE CAN

TYPICAL TUNING
SOLUTIONS
IN LESS THAN
3 SECONDS





**TACTICAL RF
3MHz TO 30MHz
SKYWAVE PROPAGATION**

HF is used by the military because it does not rely on satellites nor direct line-of-sight from transmitter to receiver.

**SWA
HF Auto-Tuner
Frequency
Range is
1.8MHz to
30MHz**

**1.8MHz TO 3MHz
GROUNDWAVE PROPAGATION**

INTRODUCING OUR HF AUTO-TUNER



PART #1300-022



SWA HF AUTO-TUNER QUICK STATS

- ≡ **SWA PROPRIETARY TUNE ONCE TECHNOLOGY**
- ≡ **DESIGNED FOR PORTABILITY, IT'S THE SIZE OF A 16 OZ. BEVERAGE CAN**
- ≡ **TUNE ANTENNAS FROM 40 VSWR TO 1.5 VSWR IN SECONDS**
- ≡ **CONTAINS 8,000,000 POSSIBLE COMBINATIONS & CIRCUITS**
- ≡ **25 WATT MAX INPUT POWER IN A 50 OHM SYSTEM**
- ≡ **512 CUSTOMIZABLE MEMORY CHANNELS**
- ≡ **ROOM FOR 10,000 NEW MEMORIZED RESULTS**
- ≡ **16 BIT DELTA-SIGMA ANALOG TO DIGITAL CONVERTERS**
- ≡ **32 BIT FLOATING POINT MICROPROCESSOR**
- ≡ **VERY POWERFUL COMPUTATIONAL ENGINE**



**OUR CUSTOMERS HAVE ASKED FOR AN
HF AUTO-TUNER THAT THEY CAN INTEGRATE
INTO THEIR RADIOS AND SYSTEMS.**

This Technology Demonstrator HF Auto-Tuner gives your team a hands-on, lab-ready platform to fully explore the capabilities. Once validated, we'll collaborate with you to engineer a seamless, purpose-built integration tailored to your system's operational demands.



**INTEGRATE OUR HF AUTO-TUNER SEAMLESSLY INTO
YOUR RADIO /SYSTEM.**

**CUSTOM
HF AUTO-TUNER
MODULE**



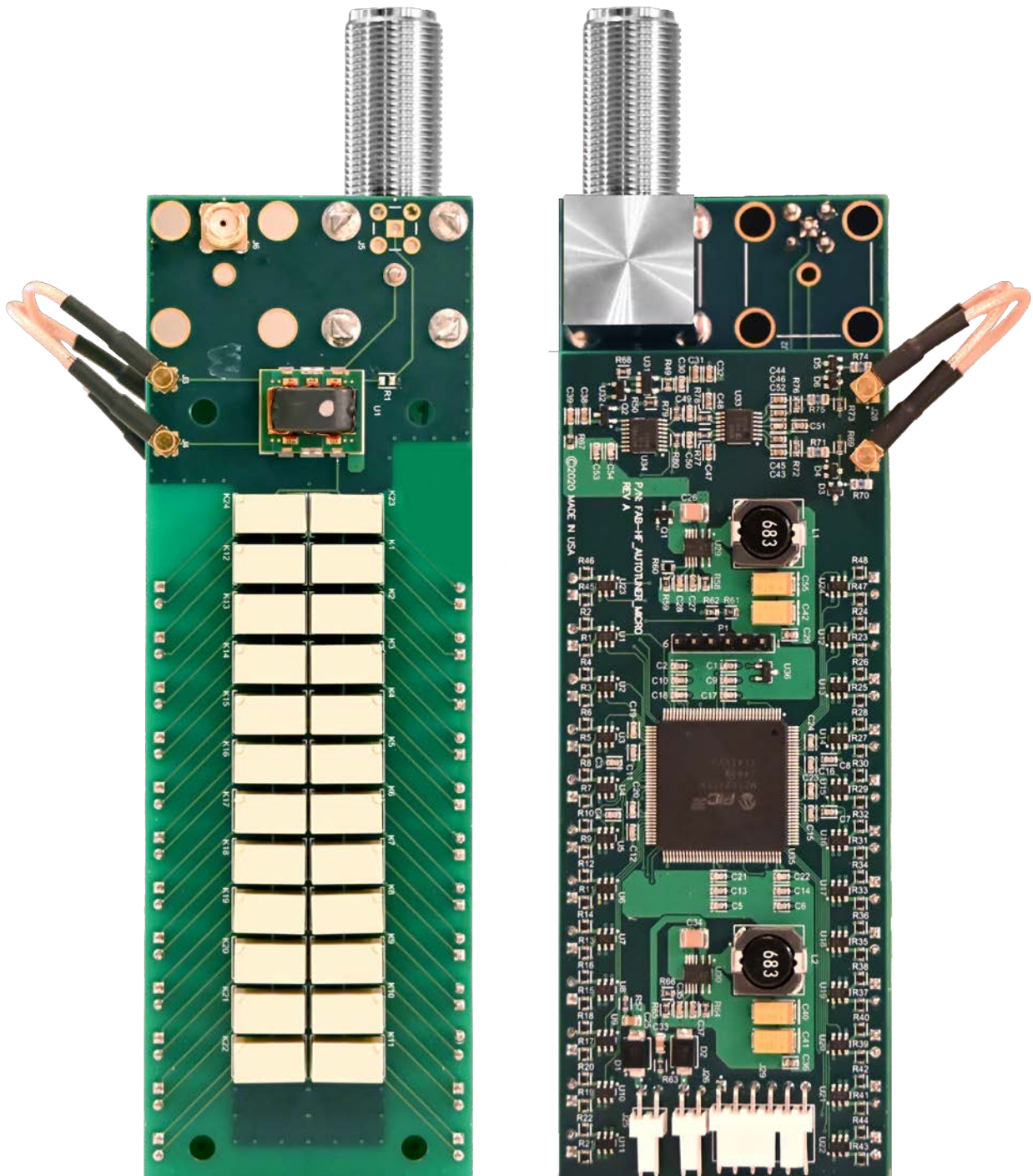
**COLLABORATE WITH US TO
DESIGN AN HF AUTO-TUNER
MODULE TO CONNECT TO
YOUR SYSTEM**

**TECHNOLOGY DEMONSTRATOR
/ LABORATORY VERSION
AUTO-TUNER**

PART #1300-022



INSIDE THE TECHNOLOGY DEMONSTRATOR ARE TWO PCB BOARDS MOUNTED IN A BACK-TO-BACK CONFIGURATION. THIS ASSEMBLY ALLOWS ACCESS TO COMPONENTS AND CIRCUITRY ON BOTH SIDES AND THEY FIT EASILY INTO THE 7.15" x 2.70" x 2.50" ENCLOSURE. SHOWN BELOW ARE VIEWS OF EACH BOARD SIDE.



SWA HF AUTO-TUNER TESTING PARAMETERS

OUR HF AUTO-TUNER HAS THE BEST
TUNING COVERAGE ON THE MARKET

TUNE ANTENNAS FROM
40:1 VSWR TO
1.5:1 VSWR
IN SECONDS

These are real results,
after thousands of tests.

The orange circle represents
a VSWR of 40.

In **95% of our tests** the HF
Auto-Tuner tunes the antennas to a
VSWR of 1.5:1

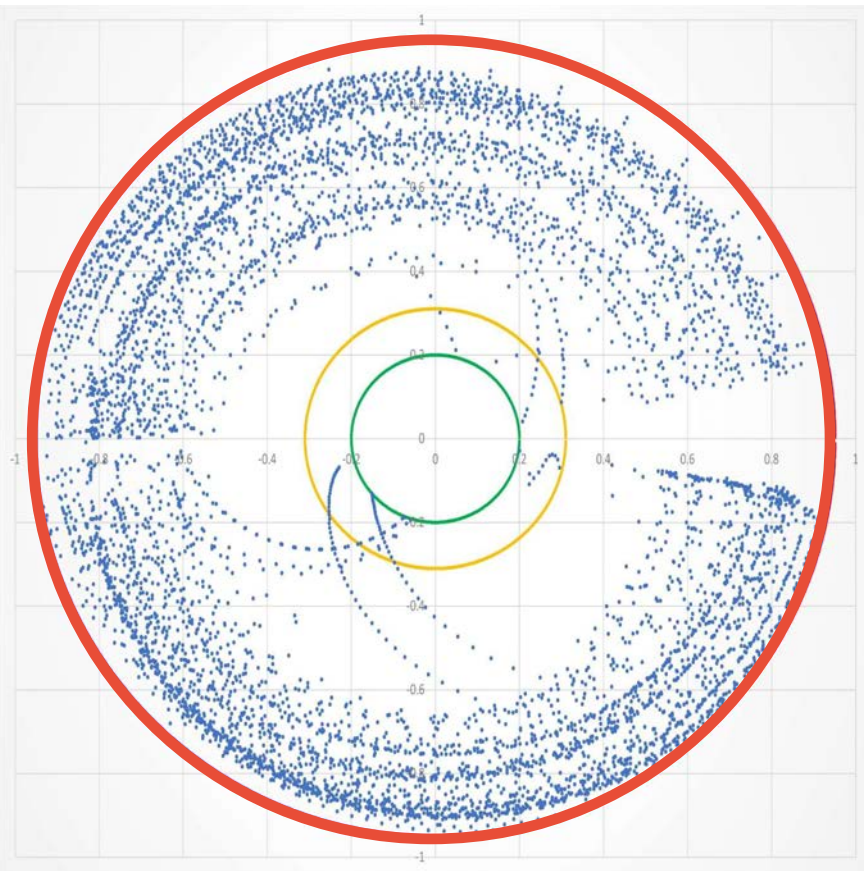
This translates to
96% of the intended power
being presented to the antenna.

In **98% of our tests** the HF
Auto-Tuner tunes the antennas to a
VSWR of 1.9:1

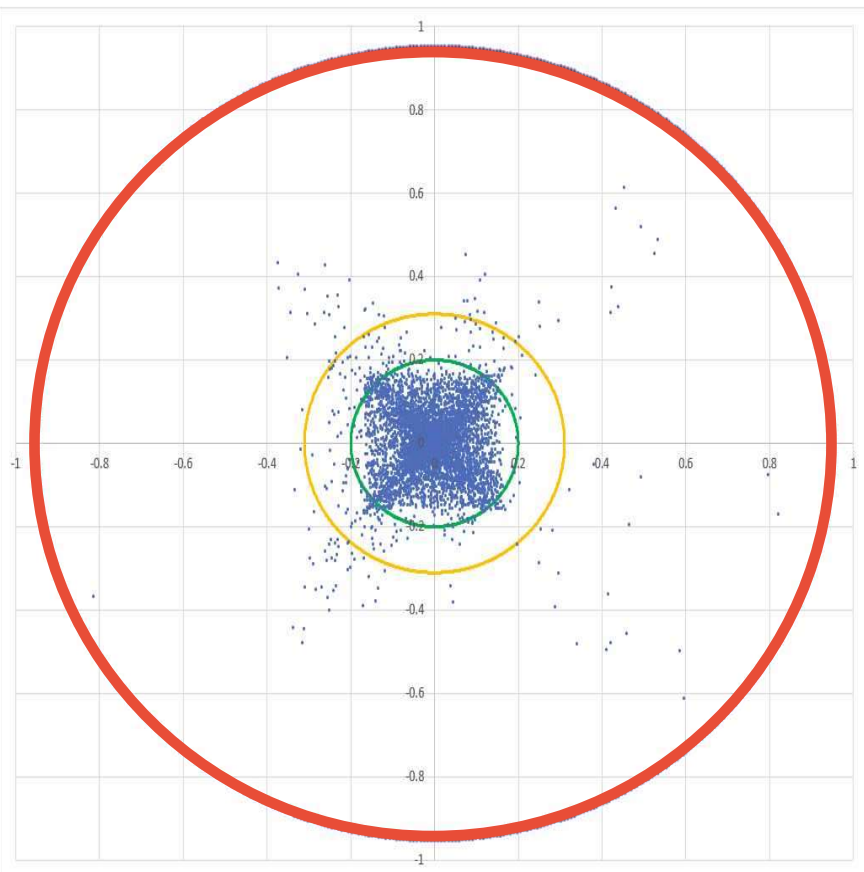
This translates to
90% of the intended power
being presented to the antenna.

The top figure shows the VSWR
starting points of each of these an-
tennas

The Bottom graph demonstrates the
VSWR results of the antennas after
the HF Auto-Tuner applied
a tuning solution, inserted a circuit
selection and impedance
matched them.



Grouping Before Impedance Matching



Grouping After Impedance Matching

05

SOUTHWEST ANTENNAS' PROPRIETY TUNE ONCE TECHNOLOGY

Once the HF Auto-Tuner tunes and impedance matches the antenna at a given frequency, it saves that solution in memory.

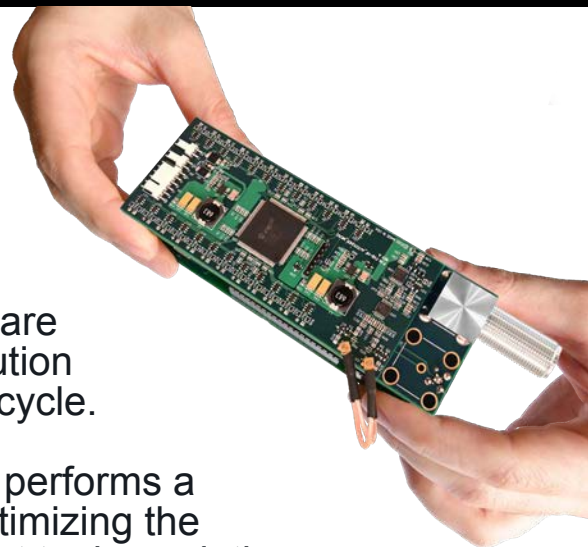
The next time an antenna match is requested, the firmware checks its internal database first. If a prior matching solution exists, it loads it instantly rather than starting a full tune cycle.

If no stored antenna match is found, the HF Auto-Tuner performs a complete tuning sequence: sweeping, adjusting, and optimizing the antenna matching circuit in seconds. Once validated, that tuning solution is saved so future impedance matches resolve faster.

Whether applying a previous tuning solution or generating a new one, the HF Auto-Tuner always runs a final verification step to confirm the match is within acceptable limits.

This is the foundation of Southwest Antennas' Tune Once Technology: the system learns from past tuning results and then uses them for rapid and repeatable tuning the next time the HF Auto-Tuner is deployed.

Every unit ships with thousands of pretested tuning profiles, giving each HF Auto-Tuner a strong baseline and ensuring highly consistent performance across devices.



HF AUTO-TUNER TUNING TIMES

MINIMUM TIME TO TUNE= 1 SECOND

TYPICAL TIME TO TUNE= 3 SECONDS

MAXIMUM TIME TO TUNE= 45 SECONDS

No matter how long it takes to tune, it only needs to be tuned once and the solution will be saved in memory to use next time you need that specific tuning solution.

HF AUTO-TUNER OPTIONS

Our HF Auto-Tuner Technology Demonstrator has a USB Connection, a Type-N (F) RF input & output connectors and uses a Window's application for programming and control.

If you want to integrate our Auto-Tuner into your radio or system, choose the connector you want and tell us what your preferred interface is and any other requirements

**USB
TTL RS232
RS422
RS485
ASCII Commands
And many more**

**IP67
Environmentally
sealed
Enclosures**

HOW IT WORKS

For efficient transmission, the radio's source impedance must be properly matched to the antenna's load impedance at the feed point. While an antenna's resonant behavior depends on its physical geometry and how it's installed in the real world, the Southwest Antennas HF Auto-Tuner handles the critical task of matching the radio to the antenna. By ensuring a correct impedance match under varying conditions, the HF Auto-Tuner enables the radio to deliver maximum available RF power to the antenna with minimal loss.

WHY DID WE DESIGN THE AUTO-TUNER FOR THE HF BAND?

The military continues to rely on HF because it provides long-range communications without depending on satellites or requiring line-of-sight between the transmitter and receiver. Signals from roughly 3 MHz to 30 MHz propagate as skywave, reflecting off the ionosphere and allowing communications to clear mountains, dense terrain, and other large obstructions. Below 3 MHz, HF energy couples to the Earth's surface and travels as ground wave propagation, following the terrain over significant distances. Together, these propagation modes enable resilient, beyond-line-of-sight communications without satellites, which can be degraded, hacked, denied, or destroyed and without building relay towers or microwave infrastructure. This allows signals to be sent hundreds of miles and in some cases even thousands of miles between continents.

512 MEMORY CHANNELS

The HF Auto-Tuner also includes 512 user-programmable memory channels. This protected memory space can only be written to or modified by the operator, allowing custom tuning profiles to be stored, labeled, and recalled as needed. If a user routinely operates a specific antenna at a specific frequency and the Auto-Tuner generates an optimal match, that solution can be saved under a descriptive name for quick access in the future. These named entries can be viewed, recalled, and applied on demand, making it easy to manage multiple configurations or support multiple operators using the same equipment. While 512 channels exceed the needs of most users, the capacity ensures ample room for shared systems, diverse mission profiles, and long-term configuration management.

PERSISTENCE

Once a tuning cycle is complete, the user can disconnect the battery entirely and the matching solution will stay in place indefinitely. For missions where conserving power is critical, an operator can simply power on the HF Auto-tuner, run a match, unplug it, and the optimized tuning network will continue functioning without drawing any additional DC current.

THE SOUTHWEST ANTENNAS AUTO-TUNER IS A GAME CHANGER IN THE FIELD.

Real-world environments introduce dozens of variables that can weaken performance, detune the antenna, reduce range, or cause complete communication failure.

Understanding these factors is critical for designing, selecting, and deploying the right antenna solutions, especially for mission-critical applications where reliability is non-negotiable.

This is why our HF Auto-Tuner is a game-changer, it automatically optimizes your antenna in the harshest conditions, giving you stronger signals, longer reach, and uncompromised reliability when it matters most.

THE JOB STILL HAS TO GET DONE EVEN WITH ALL THESE POSSIBLE OBSTACLES.

DAMAGE TO THE ANTENNA OR RADIO IN THE FIELD

ATMOSPHERIC CHANGES

NEARBY METALLIC OBJECTS

ANTENNA HEIGHT

SOLAR ACTIVITY

TIME OF DAY

PROPAGATION CONDITIONS

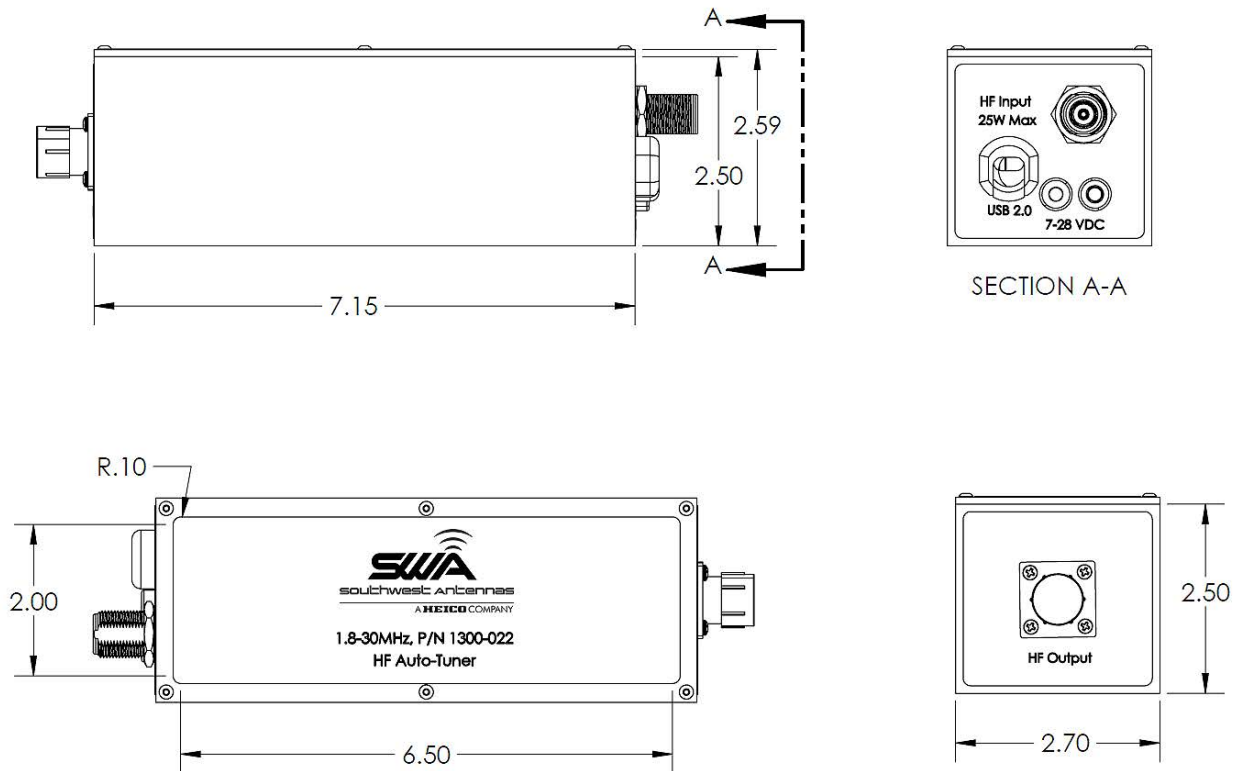
RECEIVING ANTENNA'S CAPABILITIES

LARGE BODIES OF WATER

DENSE FOLIAGE OR FORESTS

OTHER NEARBY ANTENNAS OR RF PRODUCTS

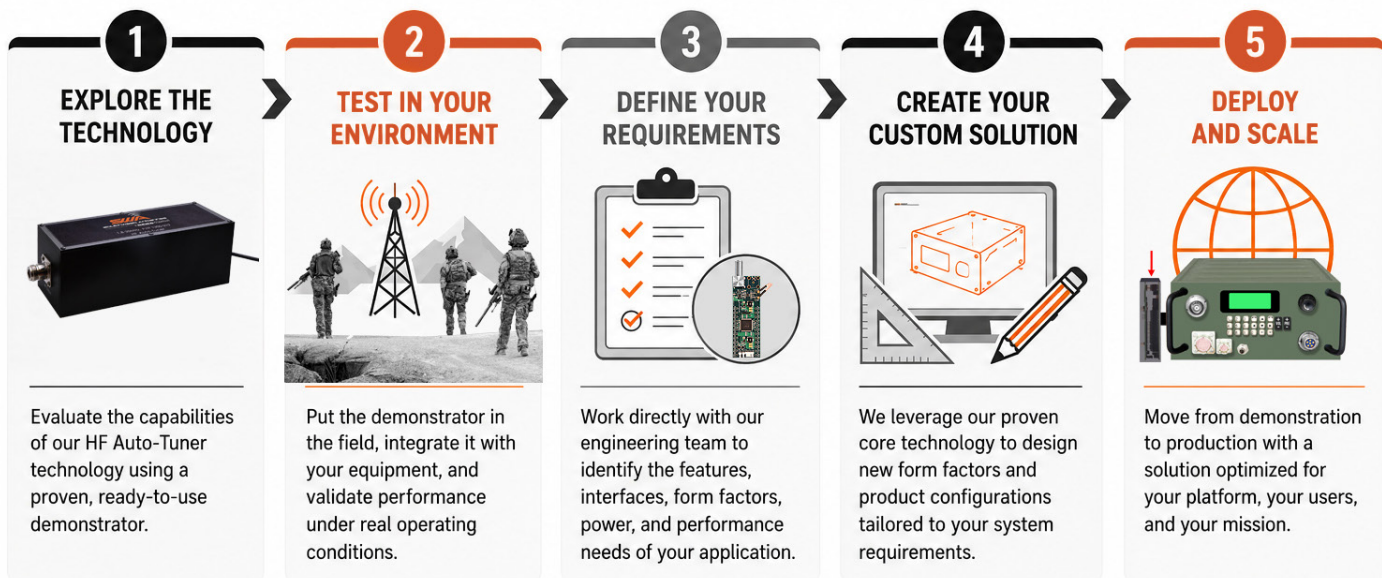
DRAWINGS



FROM DEMONSTRATOR TO DEPLOYMENT

A proven path to your ideal HF Auto-Tuner solution.

Test it. Define it. Build it. Deploy it. Repeat.



Our goal is simple:

Partner with customers to develop the next generation of HF Auto-Tuning solutions.



GET A UNIT. TEST IT. CHALLENGE IT.
THEN LET'S BUILD THE VERSION
YOUR APPLICATION ACTUALLY NEEDS.

HF AUTO-TUNER SPECS PAGE

PARAMETER	VALUE	UNITS	TOLERANCE
FREQUENCY BAND	HF		
IMPEDANCE	50	Ohms	< OR = 2.0:1 VSWR WHEN TUNED
MINIMUM FREQUENCY	0.0018 / 1.8	GHz / MHz	
MAXIMUM FREQUENCY	0.03 / 30	GHz / MHz	
FREQUENCY BANDWIDTH	0.0283 / 28.3	GHz / MHz	
MINIMUM TUNE TIME	<1	SECOND	3 SECONDS TYPICAL
MAXIMUM TUNE TIME	45	SECONDS	
TUNE FROM MEMORY	<10	MILLISECONDS	
MAXIMUM RF INPUT POWER	25	WATTS	
MAXIMUM RF TUNE POWER	24	dBm	10 Vpp, ADJUSTABLE WITH TPAD CHANGE
MINIMUM RF TUNE POWER	18	dBm	5 Vpp, ADJUSTABLE WITH TPAD CHANGE
VOLTAGE RANGE	7 - 28	VDC	
OPERATING CURRENT	1mA SLEEP 50mA STANDBY		1.2 MAXIMUM (FOR 4 ms DURATION)
OPERATING TEMPERATURE RANGE	- 40 TO +85	C	
PRODUCT LENGTH	7.15 / 181.61	inches / mm	
PRODUCT WIDTH	2.70 / 68.58	inches / mm	
PRODUCT HEIGHT	2.59 / 65.79	inches / mm	
PRODUCT WEIGHT	2.07 / .094	lbs / kg	
RF INPUT CONNECTOR	TYPE - N (F)		
RF OUTPUT CONNECTOR	TYPE - N (F)		
VDC & GAD CONNECTIONS	BANANA JACKS (RED & BLACK)		
USB CONNECTOR TYPE	TYPE - A		
ENCLOSURE	BLACK ANODIZED ALUMINIUM		10



OUR GOAL IS TO CONNECT PEOPLE TO THEIR MISSIONS

